Introduction:
Currently morbidity & mortality due to traumatic injuries area well recognized major public health problem. Similarly the traumatic brain injury is a major public health concern world wide; according to the predictions, neurotrauma will account an increasing number of deaths world wide by 2020. Among patients who are hospitalized with severe traumatic brain injury 60% either die or survive with severe disability.¹

Traumatic brain injury is defined as an acute injury to the head caused by blunt or penetrating trauma or acceleration/deceleration force excluding degenerative & congenital problem. Glasgow coma scale (GCS) score is used to grade TBI; mild = (13-15), moderate = (9-13), Severe = (3-8).² Normal intracranial pressure(ICP) in adults in below 15 mm of Hg. If it is maintained above 20 mm of Hg in patient with TBI, it is determined to be pathological & appropriate adjustment is necessary. However many patients with severe TBI have raised intracranial pressure that is refractory to first tier therapies. In such cases, surgical decompressive craniectomy performed to control ICP. Fronto temporo parietal DC was done in whom first tier intensive care & neurosurgical therapies had not maintained ICP below accepted targets. The aim of this study is to review about DC, multiple factors, outcome & complication.

Decompressive Craniectomy is a surgical procedure which involves removal of a large part of the skull and opening of the underlying duramater. Primary DC refers to leaving a large part of the skull (bone flap) out after evacuating an intracranial haematoma (mass lesion) in the early phase after the head injury. A DC may also be undertaken in head-injured patients who are managed in an intensive care unit (ICU) with ICP monitoring. This is usually referred as a secondary DC. However, even though >100 years have passed since the first description of DC by Theodor Kocher in the 20th century. The first modern report of the use of DC following TBI was published by Harvey Cushing in 1908.³

1. Col. (Dr.) Md. Aminul Islam, Head of Department of Neurosurgery, CMH, Dhaka
2. Maj (Dr) Rajib Shahriar, Consultant Surgeon, CMH, Saidpur.
3. Col. (Dr.) Rukun Uddin Chowdhury, Consultant Neurosurgeon, CMH, Dhaka.
4. Lt. Col. (Dr) MAA Salek, Consultant Neurosurgeon, CMH, Dhaka.
5. Dr. Md. Rezaul Alam, Associate Professor of Neurosurgery, Rajshahi Medical College.

Address of Correspondence: Col. (Dr.) Md. Aminul Islam, Head of Department of Neurosurgery, CMH, Dhaka.
Material & Methods:

Study Design
This was designed as a retrospective randomized clinical study. The study conducted in Combined Military Hospital (CMH) Dhaka Cantonment & approved by the institute. As the patients in this study were unable to give consent, therefore informed consent obtained from the subjects legal guardian or healthy proxy before accepting the advised treatment. The duration of the study was July 2015 to May 2018.

Study Population
During this period, 37 patients with severe TBI underwent decompressive craniectomy were included in this study.

Management Procedure
All patients in the study were treated in ICU with advanced neurosurgical management capabilities & equipments. Medical management such as dehydration with mannitol & other pharmacological agents, physical measures adopted to maintain posture to keep ICP normal, control of convulsion etc, along with serial CT scan (meantime 5 hours) for further evaluation and prompt measure. The mode of DC was elective at the fronto parieto temporal region based on CT scan. After surgery patient were monitored clinically to exclude raised ICP in ICU/HDU by heart rate, respiration rate, blood pressure, arterial Oxygen saturation.

Outcome Measures
The original outcome was the proportion of patient with good recovery, vegetative state or disability (based on Glasgow outcome score, GOS), as assessed with the use of a structured validated questionnaire at 6 month after injury. The outcome also includes total duration of hospital stay, morbidity & mortality.

Results:
The total 37 patients with TBI followed by DC were clinically evaluated. There were 27 male & 10 female patients, that is 75% & 25% respectively. Regarding age the median age of this patients was 28 years with mean of 35.7. Categorically the age group 12-30 years showed the highest rate of accident (54%) & lowest was 51-60 years (7%) (figure-1).

The mechanism of injury is also important as it impacts on result. The commonest mechanism of injury was road traffic accident. Motor vehicle accidents accounted the most number of injuries in 30 cases (81%), fall from height 5 cases (13.5%), others like pedestrian injury, industrial accidents, sports etc 2 cases (5.4%) (Table-1).

Preoperative GCS score showed in this study was 3-5 in 9 cases (24.3%) & 6-8 in 28 cases (75.7%). Craniectomy was undergone from 2 to 24 hours; of which 21 patients within 6 hours, 10 patients within 12 hours & 6 patients more than 12 hours With correct clinical assessment & duly timed decompression there is different patterns of hospital stay (ICU, CCC, HDU) was observed; duration of hospital stay was less than 30 days in 27 patients (73%) & more than 30 days in 10 patients (27%) (Table-1).

The overall neurological outcome after DC is very good. The outcome was based on GOS (Glasgow outcome score 1-5) it shows 15 patients (41%) has GOS score 5 at six months of follow up (Table-2).

<p>| Table-I |</p>
<table>
<thead>
<tr>
<th>Variable</th>
<th>DC group</th>
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<tbody>
<tr>
<td>Number of patients</td>
<td>27 (M) 73%, 10 (F) 27%</td>
</tr>
<tr>
<td>GCS score</td>
<td>3-5 9 (24.3%), 6-8 28 (75.7%)</td>
</tr>
<tr>
<td>Mechanism of injury</td>
<td>motor vehicle 30 (81.1%), Fall 5 (13.5%), Other (industrial accident, Pedestrian injury, sports etc) 2 (5.4%)</td>
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<tr>
<td>Timing of surgery</td>
<td>With in 6 hours 21, More than 6 hours 16</td>
</tr>
<tr>
<td>Hospital stay</td>
<td>less than 30 days 27 (73%), More than 30 days 10 (27%)</td>
</tr>
</tbody>
</table>

| Table-II |
| GOS scores | DC group ( n=37) |
| 5 | 15 (41%) |
| 4 | 6 (16%) |
| 3 | 5 (14%) |
| 2 | 1 (3%) |
| 1 | 10 (27%) |
DC is not exempt of complications; these can appear following a time dependent pattern first things can happen are expansion of hemorrhagic contusion followed by appearance of new subdural haematoma on contralateral side, seizure, leakage of CSF & brain herniation etc. In this study 2 cases developed conencephalocele (1 died & other in vegetative state). Delayed intracranial haematoma in 8 cases & contralateral subdural effusion in 2 cases. Other complications are infection, electrolyte imbalance, hypoglycaemia etc. (Table-III)

**Table-III**

<table>
<thead>
<tr>
<th>Complications</th>
<th>Number of patients</th>
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</thead>
<tbody>
<tr>
<td>Conencephalocele</td>
<td>2(5%)</td>
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<tr>
<td>Delayed intracranial haematoma</td>
<td>8(22%)</td>
</tr>
<tr>
<td>Contralateral subdural effusion</td>
<td>2(5%)</td>
</tr>
<tr>
<td>Others (Hypoglycaemia, infection etc)</td>
<td>4(11%)</td>
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**Discussion**

Among with severe diffuse traumatic brain injury and refractory intracranial hypertension in the ICU, we found that decompressive craniectomy decreased intracranial pressure, the duration of mechanical ventilation, and the duration in ICU, as compared with standard medical care. It is very difficult to decide what kind of operation can not only reduce ICP but also protect the cerebral tissue from secondary brain injury resulting from hypoperfusion and/or hypopressure. Although DC has been rekindled in different studies, this procedure is neither first-line treatment nor standard of care in severe TBI. The time of the DC is one important factor, especially for post-traumatic brain swelling with subdural hematoma.

In this study, road traffic accident (RTA) was the most common mechanism of injury seen in the most productive age group of 12-30 followed by falls and assaults. This study did not find any significance in gender in predicting outcome as did some studies. However, in our study number of the female is only 10 compared to the 27 males. This was probably due the fact that females generally travel less on the road and maximum female are nonprofessional, usually stay at home. P Sharda, S Haspani, Z Idris observed prognostic factor about DC & found nearly similar outcome regarding age sex and nature of head injury.

DC has some complications such as intracerebral hematoma, subdural effusion & other complications but over all neurological outcome is good based on GOS (Glasgow outcome Score); David B Kurala, Ariana Khaladj, J Marc described in there trial that the complications is much low but current study shows better neurological outcome. Possible explanation of the complications with Craniectomy in this study may be due to delay in reporting to hospital, extent of primary injury, failure of proper postoperative care. In our study most of the surgical intervention done within 6 hours had good recovery. Though Kai Z, W. Jiang, Haorong Wu could not find any difference in their study between early and late DC.

Amos O Adelye has made good correlation with Preoperative GCS and outcome with hospital stay. Our study also finds better preoperative GCS with favorable outcome and less hospital stay.
There is some limitations of our study. It is a single center study, population size is small, ICP monitored clinically (not by manometer) and outcome assessed for small duration.

Conclusions:
Decompressive craniectomy is performed in many neurotrauma centers worldwide. DC is an efficient technique to reduce intracranial hypertension. Skilled evacuation, early hospitalization, improved postoperative care will help to make a better outcome of DC patient.

References: